NORTHWESTERN UNIVERSITY | SCHOOL OF PROFESSIONAL STUDIES

Midterm Exam

Points possible: 100

Description: The midterm exam will cover topics from sessions 1-4.

Resources: The exam is completely open book. You may use course textbooks, materials provided on Canvas, graphing calculators (such as TI 83 or 84); *but any more advanced calculators, Excel Solver, Web calculators, Web-graphic calculators, or simplex method calculators are not allowed. Programming languages other than Python are also not permitted*.

For questions that require calculations, all calculations should be shown, not just the final answer. This will allow for partial credit for those answers that might be set up correctly but have calculation errors. For questions that specifically require Python, the code and output should be included with your answer. For questions that require graphs, only use Python.

Restrictions: All answers are to be your work only. You are not to receive assistance from any other person.

To complete the exam:

1. Answer all questions on the exam thoroughly. Create a Microsoft Word document, including the question number, the question, your typed answer, and graphs if required. You may use Word's equation editor to complete your answers.

2. Once you have completed your exam, return to the exam item where you downloaded the exam PDF, click View/Complete Assignment, and submit your document.

1. A lumberyard has fixed costs of $2,811.60 a day and variable costs of $1 per foot of board produced. The company gets $2.80 per foot of board sold. How many feet of board must be produced daily to break even? Solve this problem graphically, **using Python.**

2. A company has 180 sales representatives, each to be assigned to one of four marketing teams. The first team is to have three times as many members as the second team and the third team is to have twice as many members as the fourth team. How can the members be distributed among the teams?

3. The 2010 birth and death rates per million for several regions and the world population (in millions) by region are given in the tables below. **Use Python** to determine the total number (in millions) of births and deaths for each year.

	Births	Deaths
Region 1	0.0341	0.0115
Region 2	0.0173	0.0073
Region 3	0.0187	0.0058
Region 4	0.0135	0.0083
Region 5	0.0099	0.0102

Population (in millions)					
Year	Region 1	Region 2	Region 3	Region 4	Region 5
1970	365	2038	284	222	460
1980	476	2495	362	252	484
1990	627	2977	442	277	496
2000	801	3438	522	313	514
2010	1017	3827	591	344	522

4. Northwestern University's basketball stadium seats 15,000 people. Front row seats cost $8, lower level seats cost $4, and all other seats cost $7. The total revenue for a sellout performance is $78,000. If half of the front row seats, half of the lower level seats and all of the other seats are sold, then the revenue is $46,000. How many of each type of seat are there?

5. An airline with two types of airplanes, 737's and 747's, has contracted with a tour group to provide transportation for a minimum of 400 first class, 750 business class, and 1500 economy class passengers. For a certain trip, a 737 costs $10,000 to operate and can accommodate 20 first class, 50 business class, and 110 economy class passengers. The 747 for the same trip costs $8500 to operate and can accommodate 18 first class, 30 business class, and 44 economy class passengers. **Use Python** to determine how many of each type of airplane should be used to minimize the operating cost.

6. A political mailing will have several pages on the economy, the military, and the environment. The total number of these pages in the booklet should be less than 100. For the target group that will receive the booklet, market research suggests that there will be a positive impact proportional to 5 times the number of pages on the economy, a positive impact proportional to 2 times the number of pages on the military, and a negative impact proportional to -4 times the number of pages on the environment. The candidate, however, insists that the number of pages on the environment exceed the number on the military by at least 5 and that the number of pages on the economy also exceed the number on the military by at least 5. Find the number of pages that should be devoted to the economy, the military, and the environment.

7. One gram of soybean meal provides at least 2.5 units of vitamins and 5 calories. One gram of meat byproducts provides at least 4.5 units of vitamins and 3 calories. One gram of grain provides at least 5 units of vitamins and 10 calories. If a gram of soybean meal costs 7 cents, a gram of meat byproducts 8 cents, and a gram of grain 10 cents, **use Python** to determine what mixture of these three ingredients will provide at least 54 units of vitamins and 60 calories per serving at a minimum cost. What is that cost?

8. The manager of a concert hall estimates that 700 people attend each classical concert, 800 people attend each jazz concert, and 300 people attend each rock concert. In any given month, the total of the number of classical concerts and the number of jazz concerts may not exceed 10 and the number of rock concerts must be no more than 8. Furthermore, there should be twice as many rock concerts as classical concerts in any given month. How many of each type of concert should there be in a moth to maximize attendance?

9. A company is conducting a sweepstakes and ships two boxes of game pieces to a particular store. Box A has 2% of its contents being winners, while 4% of the contents of box B are winners. Box A contains 39% of the total tickets. If the contents of both boxes are mixed together and a ticket is chosen at random, what is the probability it is a winner?

10. In one town, 8% of 18-29 year olds own a house, 29% of 30-50 year olds own a house, and 52% of those over 50 own a house. According to a recent census in the town, 26.9% are 18-29 years old, 37% are 30-50 years old, 36.1% are over 50 years old. What percentage of homeowners are 30-50 years old?